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4.2 GEOLOGY, SOILS, AND SEISMICITY

INTRODUCTION

This section describes the geology, soils, and seismicity that characterize the Project area and addresses potential project-specific and cumulative impacts resulting from these features. Impacts evaluated include:

- Potential seismic related hazards including ground shaking, ground rupture, liquefaction, differential compaction, and seismic settlement.
- Potential non-seismic hazards including erosion potential, collapsible and expansive soils, and subsidence.

IMPACTS EVALUATED IN OTHER SECTIONS

The following items are related to the Geology, Soils, and Seismicity section but are evaluated in other sections of this document.

- Groundwater: Potential environmental impacts that could affect the quantity and quality of groundwater are addressed in Section 4.3 Water Quality and Hydrology.

AFFECTED ENVIRONMENT (SETTING)

Geology

The ProStyle Sports Complex project site is located in the western part of the Great Valley geomorphic province of California between the Sierra Nevada mountains and the Coast Ranges (Draft EIR 1995). These mountain ranges were formed by geologic uplifts that occurred during the late Tertiary and Quaternary periods. The structural trough between the ranges has been filled with alluvial, lacustrine, and some marine sediments that attain a maximum thickness of over 30,000 feet near the western margin. The bedrock complex is composed of metamorphosed marine sediments similar to those found in the foothills of the western Sierra Nevada and the core of the Coast Ranges.

The portion of the Valley in the Lodi/Stockton area exhibits a fairly complete stratigraphic section of Cretaceous, Tertiary and Quaternary deposits. The sediments deposited prior to mid-Tertiary time were in a marine environment. Changes in sea level, valley fillings, and uplift, resulted in deposition of sediments in a continental environment after the mid-Tertiary period. These continental sediments are exposed at the surface in the Project area. Near-surface sediments have been deposited primarily during flood stages of the Calaveras, Mokelumne, and San Joaquin Rivers, prior to the present-day flood control systems.

Soils

The soils in the Project area include Guard clay loam (partially drained) and Devries sandy loam (drained) (Figure 4.2-1).

Guard clay loam is very deep, poorly drained, and has slow permeability, moderate shrink-swell potential, and low wind erosion hazard. It is classified as prime agricultural land (Capability Class II) when irrigated. The surface layer of this soil is typically dark gray or gray mottled clay loam up to 15 inches thick. The underlying material consists of light gray and light olive gray mottled clay loam to 72 inches. Below 15 inches, lime forms a weak cement in the soil, causing water to perch on the substratum after heavy rains or irrigation.

Devries sandy loam is somewhat poorly drained with moderately rapid permeability, low shrink-swell potential, and a moderate wind erosion hazard. It is classified as Class IV soils when irrigated, which is not considered prime agricultural land. The soil is moderately deep to hardpan. The surface layer is grayish brown sandy loam about 13 inches thick. In some areas this layer is loam or fine sandy loam. A shallow hardpan inhibits deep-rooted plants and can contribute to flooding.

Seismicity and Faults

Seismicity, or ground shaking is measured in two different ways – by their intensity or physical effects and by their magnitude or the amount of energy being released. The scale used to measure intensity of an earthquake is the Modified Mercalli Scale; magnitude is measured with the Richter Scale. The intensity of the physical effects of earthquakes is based on human reactions at the low end of the Modified Mercalli Scale and by geologic effects at the high end of the scale. The middle range is based largely on the degree of damage to man-made structures. Ratings are based on human observations and are not measured with instruments. The 12 levels of intensity in the Modified Mercalli Scale are:

- I. Not felt except by a very few under especially favorable circumstances.
- II. Felt only by a few persons, at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
- III. Felt quite noticeably indoors, especially on upper floors of buildings, but many do not recognize it as an earthquake.
- IV. During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building.
- V. Felt by nearly everyone; many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbance of trees, poles and other tall objects sometimes noticed.
- VI. Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
- VII. Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken.

VIII. Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures.

IX. Damage considerable in specially designed structures; well designed frame structures thrown out of plumb; damage great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously.

X. Some well built wooden structures destroyed; most masonry and frame structures destroyed with their foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes.

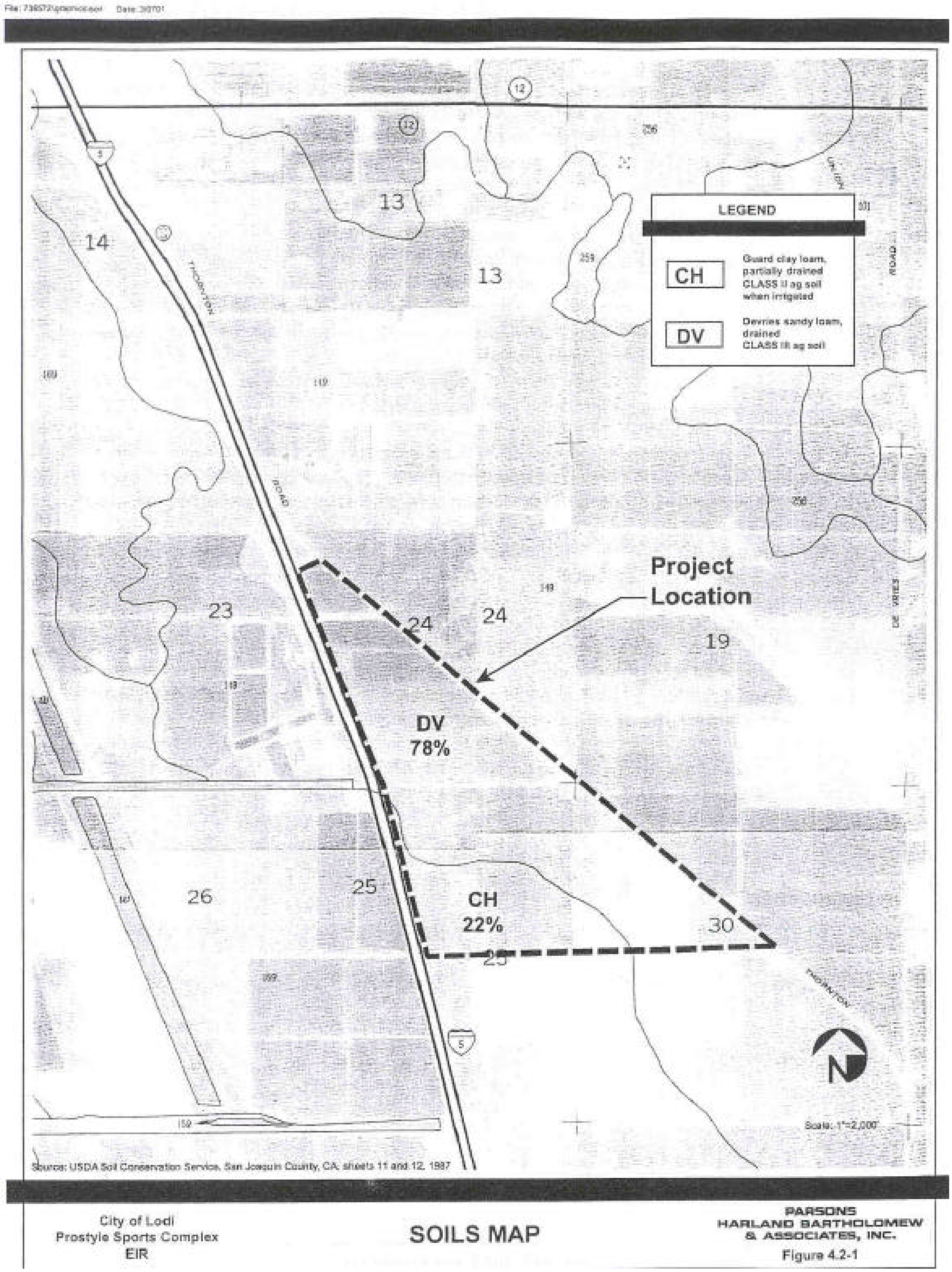
XI. Few, if any (masonry), structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipes completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.

XII. Damage total. Waves seen on ground surfaces. Lines of sight and level distorted. Objects thrown upward into the air.

The Richter Scale measures the magnitude of earthquakes using scientific instrumentation. This system can be used to rank and compare the energy released by various earthquakes. On the Richter Scale, an increase in a magnitude of 1 is equal to an increase in energy released of 32. An earthquake of magnitude 7, therefore, represents about 32 times as much energy released as one of magnitude 6; a magnitude 8 represents 32 times the energy released by a magnitude 7 and over 1,000 times the energy released by a magnitude 6.

Within the last 150 years, the Project area has experienced a variety of earthquakes of intensity V or greater on the Modified Mercalli Scale. In general the Central Valley is considered to be an area of relatively low seismicity in a state characterized by moderate-to-high seismic activity. There are several fault zones within San Joaquin County and neighboring counties that could affect Project facilities. These include the concealed Tracy-Stockton Fault approximately 12 miles to the southwest and the concealed Midland Fault zone, approximately 20 miles to the west. The Melones Fault zone is 36 miles to the east, and the Green Valley-Concord and Hayward faults are 46 and 52 miles, respectively, to the west.

FIGURE 4.2-1 SOILS OF THE PROJECT AREA



Faults are indications of past seismic activity. Faults with recent activity are presumed to be those most likely to be active in the future. However, even inactive faults may not be dead, and earthquakes may occur in areas with undetected faults. For example, in 1975 a 5.7 magnitude earthquake occurred near Oroville, a place where quakes of this magnitude were not expected. Consequently, the California State geologist acknowledged that "earthquakes of magnitude 5 can occur anywhere in California at any time" (City of Stockton 1990). These areas with undetected seismic activity include active faults, which are faults that may have been historically active (during the last 200 years), or active in the geologically recent past (about the last 11,000 years), and inactive faults (no record of activity).

Faults that have been active at some time during the Quaternary geologic period (the last two million years) are classified as potentially active. Tables 4.2-1 and 4.2-2 summarize the activity history and maximum credible earthquake intensity recorded for each of the faults that could affect the Project area (measured at the epicenters of those quakes), and the maximum probable intensity of an earthquake that could occur at the Project site.

Table 4.2-1

Earthquakes with Modified Mercalli Intensity V or Greater in Project Area

Date	MM Intensity in Project Area[1]	MM Intensity at Epicenter	Epicenter	Richter Magnitude at Epicenter
1838	VI	X	S.F. Peninsula	7+
1857	VI	X-XI	Mountains between Santa Barbara and Bakersfield	8+
1868	V-VI	IX-X	Hayward	7+
1872	VI	X	Owens Valley	8+
1881	V-VI	VII	Linden	5+
1892	IV-V	VIII	Vacaville	Approx. 7+
1883	V-VI	IX-X	Hayward	7+
1906	VI-VII	XI	San Francisco	8.3
1940			SE of Linden	4.0
1946			Patterson Pass	4.5
1952	V	VIII	Bakersfield	Approx. 5.7
1966	IV-V	VII	North of Tahoe	Approx. 6.5

Source: City of Stockton 1990

Table 4.2-2

Faults that Could Affect Project Facilities

Fault	Distance from Stockton (miles)	Maximum Probable Earthquake[1] (Richter Scale)	Maximum Credible Earthquake[2] (Richter Scale)	Maximum Intensity of Maximum Credible Earthquake (MM Scale)	Recurrence Interval (years)	Years of Historic Damaging Earthquakes
San Andreas	66	7.8-8.25	8.25-8.5	VIII to IX	300	1838, 1906
Hayward	48	7.25	7.0-7.5	VIII to IX	264	1836, 1868
Calaveras	40	6.75	6.75-7.3	VIII to IX	150	1861
Green Valley-Concord	41	6.7	6.5-7.25	VIII to IX	319	1955
Midway	24	6.3	6.3	VII to VIII	2,651	--
Midland	19	--	7.0	VIII to IX	--	1889?
Tracy-Stockton	12	--	5.0	IX	--	--
Paterson Pass	34	--	4.5	--	--	--
Melones-Bear Mountain Zones	36	6.8	6.0	--	>10,000	1975
Small Buried Fault	20	--	--	--	--	--
Telsa and Black Butte	29	6.3	--	--	--	--

Sources: City of Stockton 1990; San Joaquin County 1991

1. Maximum probable earthquake is the maximum earthquake that appears to be reasonably expected within the next 100-year period.
2. The maximum credible earthquake is the maximum earthquake that might reasonably occur under the conditions presently known.

Seismic Hazards

Seismic hazards include ground shaking, ground rupture, differential compaction and seismic settlement, and liquefaction. Strong ground shaking can damage structures, their foundations, and contents. Strong ground shaking may also trigger secondary effects such as liquefaction or ground settlement in some areas.

Ground Shaking

Strong shaking generated by earthquakes along any of the faults in northern California could affect the Project area, depending on the characteristics of the quake and the location of the epicenter. The most likely sources of strong ground shaking in the Project area are the San Andreas, Hayward, Calaveras, Midland, Midway, Green Valley-Concord and Tracy-Stockton faults (Table 4.2-2). The intensity of ground shaking from these faults is dependent on the earthquake's magnitude, distance, and the soil and rock properties at the Project site.

Historically the ground shaking experienced in San Joaquin County in the vicinity of the Project corresponds to a Modified Mercalli Intensity VI (Tables 4.2-1 and 4.2-2) and has not resulted in significant structural damage (Draft EIR 1995). However, the reasonable maximum expected earthquake intensity corresponds to Modified Mercalli Intensity VIII to IX (San Joaquin County 1991). Somewhat lesser intensities (VII to VIII) might be expected from major earthquakes along the Sierra Nevada Foothills, the Tracy-Stockton fault, and on faults of the San Andreas system.

Ground Rupture

The Project site does not lie on or close to known seismic faults. Although ground rupture may occur along undetected traces of known faults, the potential for this to occur at the Project site is very low (Draft EIR 1995).

Differential Compaction/Seismic Settlement

Fine-grained soil and clay are subject to seismic settlement and differential compaction. Areas with low-density silts and clays associated with fluvial depositional environments (old lakes, sloughs, swamps and streambeds) are subject to seismically-induced settlement. The extent of compaction may range from a few inches to several feet in depth. The potential for differential compaction is highest during large earthquakes. The potential for differential compaction and seismic settlement on the Project site is greatest in areas with Guard clay loam soils and lowest on the portion of the site with Devries sandy loam soil.

Liquefaction

Liquefaction occurs when a water-saturated cohesionless soil temporarily loses its strength and liquefies when subjected to intense and prolonged ground shaking.

When liquefaction occurs, building foundations may sink or tilt into underlying soil, differential ground subsidence may occur, and in steeper areas, landsliding may take place. The areas that have the greatest potential for liquefaction are those in which the water table is less than 50 feet below ground and the soils are predominately clean, relatively uniform sands of loose to medium density. Clay type soils are generally not subject to liquefaction.

The occurrence of liquefaction depends on the amplitude and frequency of the wave motion of the ground shaking and its duration. The looser the soil the shorter the duration and the less intensity the shaking needed to cause liquefaction. More dense soils can withstand longer periods of shaking and more intense shaking before liquefaction takes place. Because of the distance between the Project site and most major fault zones in northern California, the type of earthquake motion expected for the area from large earthquakes is a long rolling type of motion which is less likely to cause liquefaction. However, if an earthquake were to occur along the Tracy-Stockton fault, the motion near the fault would tend to be sharp, with high frequency vibrations, a type more likely to cause liquefaction. Because the water table of the Project site is approximately 50 feet above ground water (approximately 10 to 20 feet), and a major portion of the site contains sandy loam soils, there is reasonable potential for liquefaction to occur at the site. These conditions suggest that a major earthquake along the Tracy-Stockton fault could result in damage related to liquefaction to structures on portions of the Project site.

Soil Hazards

In addition to geologic hazards, which are specifically associated with seismic activity, the Project area is potentially subject to soil hazards that include expansive soils and erosion.

Expansive Soils

Expansive soils are soils that swell when they absorb water and shrink as they dry. Clay soils are a good example of expansive soils. The basic cause of expansion is the attraction and absorption of water in the expandable crystal structures of clays. The hazard associated with expansive soils is that when buildings are placed on these soils, foundations rise during the wet periods and fall during the dry periods. Different parts of a building may rise and fall at varying rates to cause foundation cracking. Various structural portions of a building may become distorted so that doors and windows do not function properly.

The areas of San Joaquin County with the greatest potential for expansive soil problems are the San Joaquin Delta, the areas north and west of Tracy, and the Stockton-French Camp area, and the area east of French Camp and Stockton as far as Farmington. The ProStyle Sports Complex site is located in an area of low rating for shrink-swell soil behavior. However, the site does contain Guard clay loam soil, which has a Moderate rating for expansive soils.

Erosion

The Delta area in San Joaquin County is subject to both wind and water erosion. During times of high winds (15+ mph), clouds of peat dust can be seen in the Delta. This dust is a health and safety hazard and contributes to the loss of valuable agricultural soils. On the Project site, areas with Devries sandy loam have a moderate wind erosion hazard; areas with Guard clay loam present only a low wind erosion hazard.

Water erosion potential is largely controlled by slope steepness and the characteristics of the earth materials. Silty soils are generally readily erodible, whereas sandier soils are less susceptible to erosion. Excessive erosion in the vicinity of building and pipeline structures can result in the loss of foundation support. Because of the flat terrain of the San Joaquin Delta region, erosion potential at the Project site is low.

Regulatory Framework

Building Permits

The City of Lodi has adopted building codes, based on the Uniform Building Code, that specify design and construction standards and require that an approved building permit be obtained prior to construction. The City also requires that a building inspector review plans and inspect the construction site and grant final approval upon completion of construction.

Development Standards

The City of Lodi has adopted development standards to regulate grading and to minimize environmental impacts associated with construction grading. These development standards require setbacks from property lines, erosion and sediment control, soil stockpile management methods, and inspection procedures.

National Pollutant Discharge Elimination System Permit

The federal Clean Water Act regulates the discharge of stormwater from construction sites. The State Water Resources Control Board has obtained a General Permit (No. CAS000002) for discharge of stormwater runoff associated with construction activities. Construction activities include clearing, grading, or excavation that results in soil disturbance of at least five acres of total land area. Construction activities that result in soil disturbance of less than five acres require a permit if the construction activity is part of a larger common plan of development. The owner of the land where construction would occur is responsible for obtaining coverage under the statewide General Permit and is required to file a Notice of Intent for each construction activity prior to commencement of construction.

The General Permit requires development and implementation of a Storm Water Pollution Prevention Plan and identification of a monitoring program and reporting requirements. The Storm Water Pollution Prevention Plan as specified in the General Permit (from State Water Resources Control Board Fact Sheet) must include:

a) A description of soil stabilization practices. These practices shall be designed to preserve existing vegetation where feasible and to revegetate open areas as soon as feasible after grading or construction. In developing these practices, the discharger shall consider: temporary seeding, permanent seeding, mulching, sod stabilization, vegetation buffer strips, protection of trees, or other soil stabilization practices. At a minimum, the operator must implement these practices on all disturbed areas during the rainy season.

b) A description or illustration of control practices which, to the extent feasible, will prevent a net increase of sediment load in stormwater discharge. In developing control practices, the discharger shall consider a full range of erosion and sediment controls such as detention basins, straw bale dikes, silt fences, earth dikes, brush barriers, velocity dissipation devices, drainage swales, check dams, subsurface drains, pipe slope drains, level spreaders, storm drain inlet protection, rock outlet protection, sediment traps, temporary sediment basins, or other controls. At a minimum, sandbag dikes, silt fences, straw bale dikes, or equivalent practices are required for all significant sideslope and downslope boundaries of the construction area. The discharger must consider site-specific and seasonal conditions when designing the control practices.

c) Control practices to reduce the tracking of sediment onto public or private roads. These public and private roads shall be inspected and cleaned as necessary.

d) Control practices to reduce wind erosion.

Geology, Soils, and Seismicity Goals, Objectives, and Policies

Table 4.2-3 identifies goals, objectives, and policies that provide guidance for development in relation to geology, soils and seismicity in the Project area. The table also indicates which evaluation criteria in the Geology, Soils, and Seismicity Section are responsive to each set of policies.

Table 4.2-3

General Plan Goals, Objectives, and Policies - Geology, Soils, and Seismicity

Adopted Plan Document	Document Section	Document Reference	Policies	Relevant Evaluation Criteria[1]
City of Lodi General Plan Policy Document	Health and Safety Element	Geological Hazards; Goal B	1. The City will ensure that all public facilities are structurally sound and able to withstand seismic activity. 2. The City Shall require that geotechnical investigations be prepared for all proposed critical structures before construction or approval of building permits.	2,3,4, 6
	Conservation Element	Goal D	1. The City shall require developers to prepare an erosion and sediment control plan prior to approving development that includes features such as mitigation of sediment runoff beyond proposed project boundaries and complete revegetation and stabilization of all disturbed soils (including details regarding seed material, fertilizer and mulching).	5

Source: Jones and Stokes 1991,

1. Evaluation Criteria can be found in Table 4.2-4.

EVALUATION CRITERIA WITH POINTS OF SIGNIFICANCE

According to the CEQA Guidelines, exposure of people or structures to major geologic hazards is considered a significant impact. Geologic hazards within the Project area include strong ground shaking, fault rupture, liquefaction, and other processes that could affect soil stability.

Table 4.2-4

Evaluation Criteria with Points of Significance

Evaluation Criteria	As Measured by	Point of Significance	Justification
1. Will Project facilities be located within an area of unstable slope conditions?	Geotechnical assessment of landslide risk potential	Any portion of facilities within area with an overall rating of Moderate to High	CEQA Appendix G
2. Will Project facilities be subject to ground rupture due to location near a surface trace of an active fault?	Location of facilities within an Alquist-Priolo earthquake fault zone	Any portion of facilities within zone	CEQA Appendix G; Alquist-Priolo Earthquake Fault Zone Act.
3. Will Project facilities be located in areas with soils and groundwater conditions that are susceptible to liquefaction during an earthquake?	CDMG rating of potential for liquefaction or more detailed mapping, where available	Any portion of facilities within area with a rating of High for liquefaction	CEQA Appendix G.
4. Will earthquake-induced strong ground shaking damage Project facilities?	Structural design and construction not in conformance with requirements of applicable building codes.	Construction not in conformance with applicable building codes.	CEQA Appendix G; California Health and Safety Code; California Earthquake Protection Law.
5. Will construction of the Project cause off-site water-related erosion?	Construction activities not in compliance with requirements of the Project National Pollutant Discharge Elimination System Permit (NPDES), or building and grading codes.	Construction not in compliance with NPDES or building and grading codes.	CEQA Appendix G; Clean Water Act.
6. Will Project facilities be exposed to damage due to expansive soils?	Shrink-swell potential as rated in San Joaquin County Soil Survey (Soil Conservation Service 1972)	A rating of Moderate to High for shrink-swell potential for all Project facilities	CEQA Appendix G.

Source: Parsons, 2001

METHODOLOGY

This impacts analysis is based on a review of relevant geologic literature, technical reports, and site reconnaissance of the Project area.

ENVIRONMENTAL CONSEQUENCES (IMPACTS) AND RECOMMENDED MITIGATION

Table 4.2-5

Geology, Soil, and Seismic Impacts

Evaluation Criteria	Point of Significance	Impact	Type of Impact[1]	Level of Significance[2]
1. Will the Project be located within an area of unstable slope conditions?	Any portion of facilities within area with an overall rating of Moderate to High	None	P	==
2. Will the Project be subject to ground rupture due to location near a surface trace of an active fault?	Any portion of facilities within an Alquist-Priolo earthquake fault zone	None	P	==
3. Will the Project be located in areas with soils and groundwater conditions that are susceptible to liquefaction during an earthquake?	Any portion of facilities within area with a rating of High for liquefaction	Moderate	P	⊙
4. Will earthquake-induced strong ground shaking damage Project facilities?	Construction not in conformance with requirements of applicable building code.	Potentially high	P	⊙
5. Will construction of the Project cause off-site water-related soil erosion?	Construction activities not in compliance with requirements of the project NPDES permit or building and grading codes.	None	C	==
6. Will the Project be exposed to damage due to expansive soils?	A rating of Moderate to High for shrink-swell potential.	Low to Moderate	P	⊙

Source: City of Lodi General Plan 1991

Notes:

1. Type of Impact:
   - C Construction
   - P Permanent

2. Level of Significance:
   - == No impact
   - ❍ Less than significant impact; no mitigation proposed
   - ⊙ Significant impact before mitigation; less than significant after mitigation
   - ● Significant impact before and after mitigation

Impact: **4.2-1 Will the Project be located within an area of unstable slope conditions?**

Analysis: *No Impact; All Alternatives*

The Project and Alternate site areas are located on level ground with a no landslide risk potential.

Mitigation: No mitigation is needed.

Impact: **4.2-2 Will the Project be subject to ground rupture due to location near a surface trace of an active fault?**

Analysis: *No Impact; All Alternatives*

The Project site and Alternate site are not within an Alquist-Priolo earthquake fault zone (Draft EIR 1995). Direct damage from surface rupture is considered unlikely within the study site since no faults are known to pass through the area. Ground rupture is possible along undetected traces of known faults, but the potential for this to occur at either site is low due to the distance between the Project site and known active faults (Draft EIR 1995).

Mitigation: No mitigation is needed.

Impact: **4.2-3 Will the Project be located in areas with soils and groundwater conditions that are susceptible to liquefaction during an earthquake?**

Analysis: *Potentially Significant; All Alternatives*

The Project site and Alternate site are within an area of San Joaquin County in which soil liquefaction during seismic disturbance is most likely to occur (City of Stockton 1990, City of Manteca 1988).

Mitigation: **4.2-3 Liquefaction**

All structures proposed for the Project must be constructed in compliance with seismic liquefaction requirements stipulated by the current Uniform Building Code for Seismic Zone 3.

After Mitigation: *Less than Significant; All Alternatives*

This measure reduces potential damage induced by liquefaction to the minimal levels attainable by feasible safety construction methods as required by local building codes.

Impact: **4.2-4 Will earthquake-induced strong ground shaking damage Project facilities?**

Analysis: *Potentially Significant; All Alternatives*

New facilities could be subject to significant ground shaking. Historically, the most severe ground shaking experienced in the Project area was a Modified Mercalli Intensity VI, which means structural damage was not significant (Jones and Stokes 1990). However, the maximum expected earthquake intensity for the area is a MM intensity VIII to IX (San Joaquin County 1991). During an intensity VIII event, some damage would occur to well-made structures. During an intensity IX event, damage would be considerable in specially designed structures; well designed frame structures would be thrown out of plumb; and damage in substantial buildings would be great, with partial collapse and buildings being shifted off foundations.

Mitigation: **4.2-4 Ground Shaking**

All structures proposed for the Project must be constructed in compliance with seismic requirements stipulated by the current Uniform Building Code for Seismic Zone 3.

After Mitigation: *Less than Significant; All Alternatives*

This measure reduces potential damage induced by ground shaking to the minimal levels attainable by feasible safety construction methods as required by local building codes.

Impact: 4.2-5 Will construction of the Project cause off-site water-related soil erosion?

Analysis: *No Impact; All Alternatives*

Best Management Practices required by the City of Lodi development improvement process will be used during construction. Therefore, the Project will not cause off-site water-related soil erosion.

Mitigation: No mitigation is needed.

Impact: 4.2-6 Will the Project be exposed to damage due to expansive soils?

Analysis: *Less than Significant; No Project and Alternate Site*

According to the Manteca General Plan Background Report (1988) the Alternate site is located in an area of low shrink-swell potential. Therefore, there is low risk of damage caused by expansive soils.

The No Project alternative would not result in the construction of any buildings on the Project site and would not expose buildings to damage due to expansive soils.

Mitigation: No mitigation is needed.

Analysis: *Significant; Project and Sports Use Only*

Shrinking and swelling can damage buildings, roads, and other structures if the shrink-swell potential of the soil is rated moderate to very high. The soils of the Project site have low (Devries sandy loam) and moderate (Guard clay loam) shrink-swell potential. Approximately 30% of the Project area has Guard clay loam. Structures and facilities planned in this area include a dormitory, concessions and restrooms, and baseball and soccer fields. A rating of Moderate to High for shrink-swell potential for Project facilities is considered significant.

Mitigation: **4.2-6 Expansive Soils**

As part of the building permit, ProStyle Sports will retain a registered geotechnical engineer to conduct a detailed, facility-specific soil analysis to determine the location of expansive soils. Where expansive soils are present, the following standard engineering methods shall be used to reduce or eliminate potential impacts from expansive soils:

- Removal of native soil and replacement with an engineered fill material that is not prone to shrinking and swelling.
- Soil stabilization, such as lime treatment, to alter soil properties to reduce shrink-swell potential to an acceptable level.
- Deepening footings or other support structures in the expansive soil to a depth where soil moisture fluctuation is minimized.

After Mitigation: *Less than Significant; Project and Sports Use Only*

This measure avoids impacts by removing the expansive soils, or by providing a deeper foundation or footing, or remediates the situation by changing the composition of the soil, or avoids impacts.

CUMULATIVE IMPACTS

There are three impacts – either less than significant or significant – identified in the Geology, Soils, and Seismicity Section: 1) a potential for damage from ground shaking; 2) a potential for damage from liquefaction; and 3) a potential for damage from expansive soils.

The Project will construct facilities in a seismically active area, and thus contributes to the cumulative exposure of structures to seismic hazards in the region as a whole. However, this is the case for any Project constructed in the state of California, and the actual level of risk is site-specific and would not be cumulatively increased at any particular site. Similarly, these facilities would be located in areas where there is a potential for damage from liquefaction and expansive soils. While the Project would contribute to the cumulative exposure of structures to soils hazards, the level of risk would also be site-specific and would not be cumulatively increased within the area.